Deep learning modelling techniques: current progress, applications, advantages, and challenges

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Abstract

Deep learning (DL) is revolutionizing evidence-based decision-making techniques that can be applied across various sectors. Specifically, it possesses the ability to utilize two or more levels of non-linear feature transformation of the given data via representation learning in order to overcome limitations posed by large datasets. As a multidisciplinary field that is still in its nascent phase, articles that survey DL architectures encompassing the full scope of the field are rather limited. Thus, this paper comprehensively reviews the state-of-art DL modelling techniques and provides insights into their advantages and challenges. It was found that many of the models exhibit a highly domain-specific efficiency and could be trained by two or more methods. However, training DL models can be very time-consuming, expensive, and requires huge samples for better accuracy. Since DL is also susceptible to deception and misclassification and tends to get stuck on local minima, improved optimization of parameters is required to create more robust models. Regardless, DL has already been leading to groundbreaking results in the healthcare, education, security, commercial, industrial, as well as government sectors. Some models, like the convolutional neural network (CNN), generative adversarial networks (GAN), recurrent neural network (RNN), recursive neural networks, and autoencoders, are frequently used, while the potential of other models remains widely unexplored. Pertinently, hybrid conventional DL architectures have the capacity to overcome the challenges experienced by conventional models. Considering that capsule architectures may dominate future DL models, this work aimed to compile information for stakeholders involved in the development and use of DL models in the contemporary world.